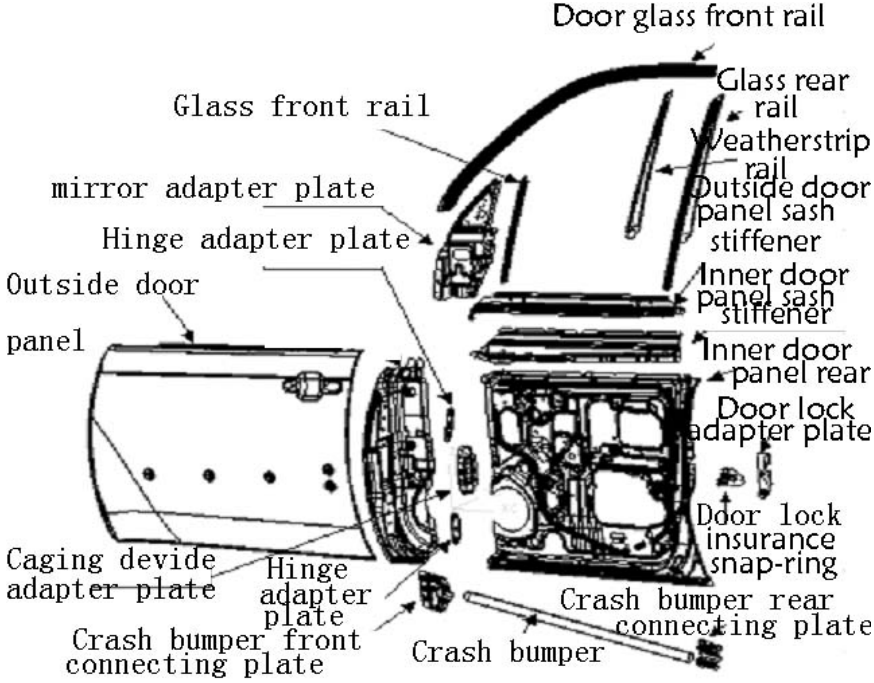
2.1 Overview of maintenance for four doors and two lids

Car body mainly consists of various kinds of framework parts, panels and other parts, technology of making door is the most complicated technology which touch upon parts stamping, parts welding, parts assembly and unit assembly, requested dimension coordination and process technique are very strict, therefore it is difficult to maintain the door, the standard of requested quality is much higher; enough understanding the structure of door is very important for the maintenance personnel to do the work smoothly.

2.1.1 Structure of door

Generally speaking, main components of door include accessories such as outside door panel、inner door panel 、door sash、glass run channel、door hinge、door lock and door window .Inner door panel is equipped with window lifter and door lock, partial inner door panel shall be strengthened for security of assembly. In order to ensure safety, bumper shall be installed inside the outside door panel. Combine inner door panel with outside door panel by means of revers, adhere and seam welding, in connection with different stand force, weight of outside door panel shall be light, stiffness of inner door panel shall be strong, so it can undertake considerable impulsive force.

Main components of door unit is relatively less in amount, it consists of outside door panel、inner door panel、glass slide、sash reinforcing slab 、door lock mount slab、hinge reinforcing slab and bumper unit in the ordinary way; A typical diagram of door's structure is illustrated as follows.



2.1.2 Technological process of door maintenance:

Generally speaking, basic method of four doors and two lids maintenance is the same as technology of common sheet metal work maintenance; the following procedures are introduced as follows:

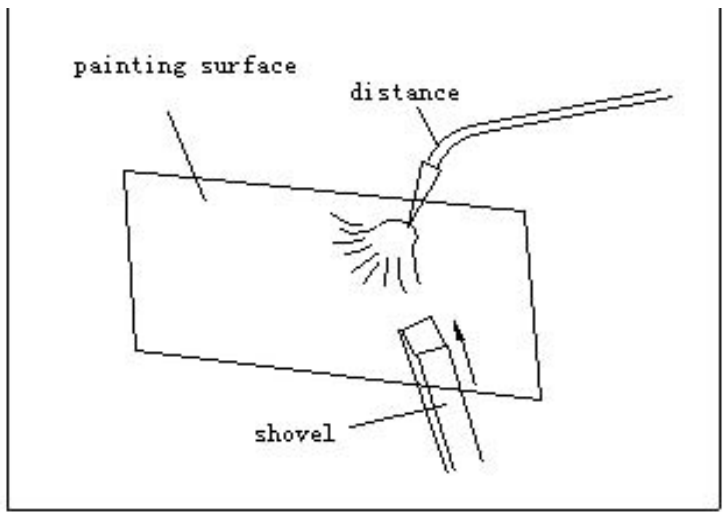
(1) Initial check

Measure the relative position and dimension between gaps for door and other car body unit.

(2) Clean the door .Clean dirt and grease stain off the door with water or detergent, make it fully dry and ready for inspection.

(3) Identification of maintenance estimation. Determine maintenance method, making estimation for the scope and degree of door's damage through inspection.

(4) Purge old painting .After cleaning or before repair, get rid of old painting according to actual condition, especially in the place of obvious rust 、 gap and concave ;Methods of paint removing are introduced as follows: hand work method 、 heating method、 apparatus method、 chemical method。



(5) Detect after disassemble. Generally speaking, it includes measurement for geometric dimensions between sheet metal parts of all kinds, inspect concrete location of damage, make clear the type of damage, analyze cause of damage, determine maintenance plan.

2.1.3 Main content of door maintenance

Generally speaking, cause of door damage has something to do with the following four aspects: defect in structural design, defect during the process of production, chemical damage while being used, physical damage while being used. Main damage causes are introduced as follows:

1. Abrasive wear. Caused by surface friction produced by relative movement because of sheet metal parts surface touch together and being weighted; for example, door is hanging down, coordination gap is enlarged because of long time abrasive wear between door hinge hole and spindle.

2. Corrosion

Oxidizing reaction of sludge-liquid and filth accumulated on surface of the metal; or rust produced by not adopting preservative treatment after welding repair or corrosion resulted by touching chemical substance. It occurs frequently in sandwich position and spot welding article joint .

3 Fissure or rupture

Fissure and rupture when it is serious, caused by sheet metal fatigue in the position of stress concentration and weak link of structure because sheet metal suffers from internal and external stress repeatedly.

4 The hollowness and fold damage.

The hollowness means that deformation of elasticity or plasticity because of collision and forcing of door panel.

5 The crooked and twisted damage. That kind of damage means crooked or twisted damage because the door undertakes too much burden.

2.2 Basic method of door maintenance

In view of above-mentioned damage type, main methods of doors and lids maintenance include sinking trim, flame straightening, weld, repair by embedding

2.2.1 Trimming the rough and uneven surface

You should correct the structural casting first then correct the crease or the hollowness of outside door panel if the rough and uneven surface of outside door panel is indirect damage because of structural casting damage or stiffening rib damage. You can carry out initial rough repair with hammer, beam pad or jimmy 、punch if you can touch the back of metal plank, you can carry out repair by means of slip hammer and peen hammer if it is difficult for you to touch the back or the metal plank is sealed.

The common rough and uneven surface trimming methods are introduced as follows:

(1)Trimming the hollowness with beam pad and hammer. It is the most common method to knock the metal plank with hammer and beam pad.The two sides of metal plank which is to be trimmed must be applicable to hand holding beam pad.There are two operating methods to take the beam pad as supporter for hammer:

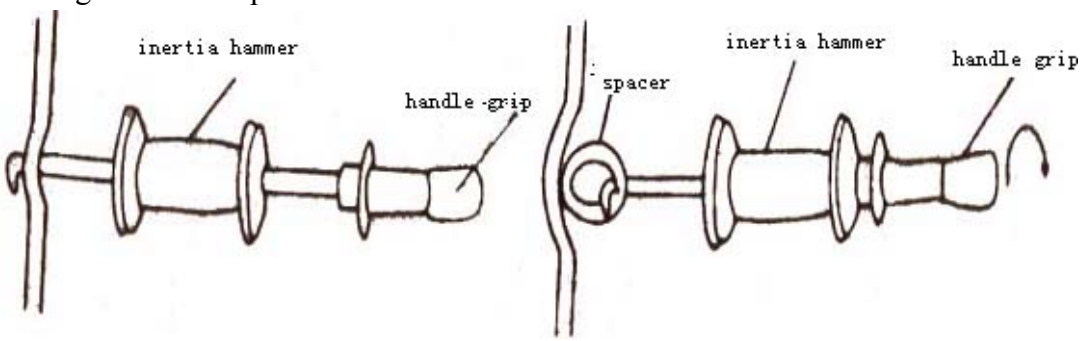
1) Knock on the beam pad with hammer. This method is applicable to the shaping to relative small and shallow hollowness and crease. You can knock the protruding from right side. The knock will result in metal plank contraction and make the metal plank to be smoothened gradually.

2)Not knocking the beam pad with hammer. This method means put the beam pad under the lowest place of the hollowness, knock the nearby place with hammer.

Generally speaking, while trimming the hollowness with hammer and beam pad ,the protruding side shall be knocked by the hammer, the other side shall be gasket ,you can make rough shaping with wooden hammer then make fine trimming with iron hammer.(see figure 7).In the case of hollowness with much bigger area, beam pad shall be put in the more shallow position of the hollowness, the hammer shall knock the much higher position of the protruding, iron hammer and wooden hammer shall be used alternately accordingly.

(2)Trim the hollowness with jimmy. jimmy can be self-made according to characteristic of the vehicle body, they are handwork tool in common use for door maintenance. can be used to put into the limited space of sandwich position of doors and lids ,it can prize open the hollowness, this kind of method can be applicable to the hollowness which is not easy for spacer and hammer to reach because of the narrow sandwich position of doors and lids, can be also used as the spacer to make the hitting power of the hammer spread in much larger area.

(3)Trim the hollowness with puller. puller can be used to trim the shallow hollowness which is difficult for other tools to touch upon, it is can be used inside the metal plank. There are two operating methods of puller in common use.



One is boring method. That means to drill a small hole in the hollowness with portable electric drill, then insert the withdrawal lever of thread summit or hook summit in the hole, draw the hollowness slowly through inertia hammer sliding on the metal withdrawal lever and colliding the handle repeatedly. You can drill more holes when necessary, fill and smooth the holes with tin-lead bonding after the hollowness is flattened.

The other method is electrode welding.That means welding the stud nail or spacer on the hollowness with special use spot welder, then pull the stud nail or spacer outwards withpuller,until the hollowness is flattened. You can weld more nails and spacer accordingly, pull the whole hollowness gradually. Finally, polish the welded mark and smooth it with grinder. This kind of method avoids making holes in the metal plank; eliminate the potential corrosion of metal.

2.2.2 Recovery of stretchable position

It happens frequently that sheet metal of the hollowness is stretched after being collided. It is not sure that the stretchable position can be recovered completely using the correct operational method during trimming process ,therefore, it is necessary for you to combine with heating contraction method to achieve the goal of trimming.

(1) Heating position and flame energy.

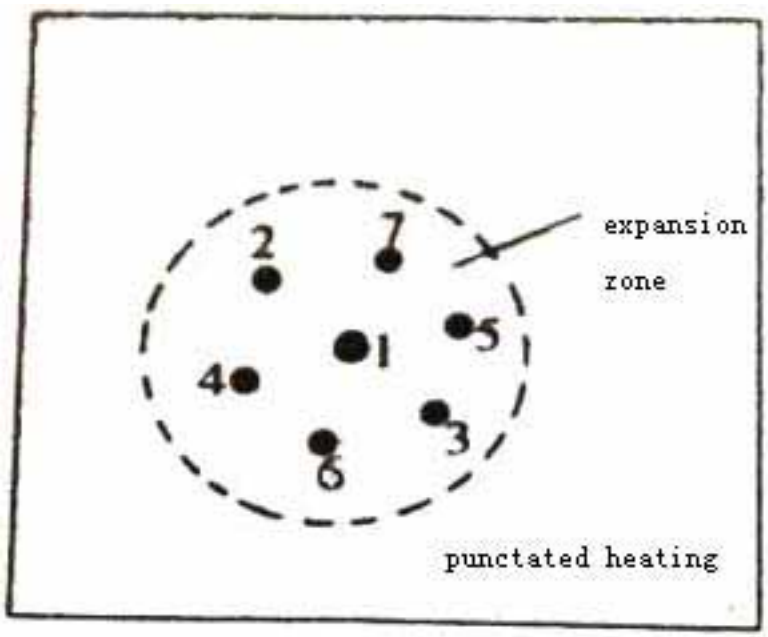
Effectiveness of flame straightening is up to heating position and flame energy, different heating position result in different straightening effectiveness. The maximum and longest deformation position shall be selected to be the heating position, that is to say the outside of deformation. Different flame energy heating results in different straightening ability. The more the flame energy, the more the heating speed, the stronger the contraction ability, the more concentrated the heating energy , it is ok to heat the low carbon sheet metal to cherry red color （600℃~800℃）.

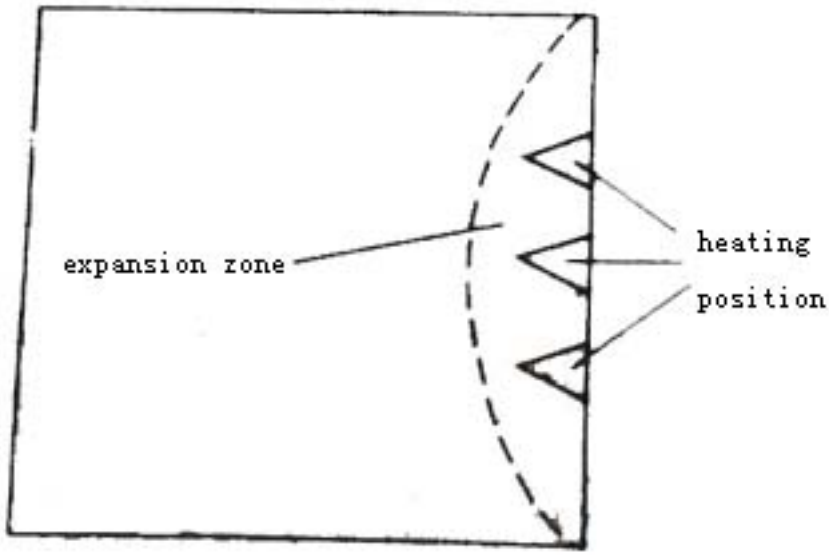
(2) Heating mode

Heating mode which flame straightening method adopt in common use in vehicle body maintenance include:

1) Point -like heating, it means that heating area is the circle-like points within certain diameter scope, generally speaking, the diameter is 15-30mm,you can heat one point or more adopting quincunx distribution accordingly, it is often applicable to the contraction of protruding in the middle of the panel.

2) Triangle heating, it means that heating area representing triangle shape, it happens frequently in the deformation of strip material and panel edge.





trigon heating

(3) Cooling contraction mode

You can choose appropriate cooling mode according to stretchable degree of sheet metal after evacuation from flame, different cooling mode result in different shrinkage.

1) Natural cooling contraction. That means natural cooling in the air, which is applicable to deformation place with smaller shrinkage.

2) Water cooling. You can cover the heating area with wet cotton cloth in order to make cooling, the shrinkage is deeper in degree than natural cooling ones, but it is easy for the sheet metal to be tendering.

3) Combination natural cooling with hammer knocking, it happens frequently to use hand hammer and spacer, knock the surrounding of heating area promptly, enlarge the contraction stress and shrinkage, until beaten that position, you'd better use wooden hammer, you'd better not put more pressure, so that the sheet metal is not to be stretched once more.

2.2.3 Made-up in digging style and restore

If local part of door sheet metal piece rot away or the damage is too serious to be repaired, you shall dig that damaged part and enchase with relevant substitute materials. It includes pasting made-up and digging made-up:

(1) Check the circumstances of damage make clear the repair scope.

(2) Make paper sample in accordance with the defined repair scope.

(3) Scribe lay off on the sheet metal according to paper sample, leave appropriate processing.

(4)Adopt suitable shaping method, make the enchase piece tally with parts needing to be repaired.

(5)Keep the enchase pieces close to the requested position, draw the bordering line of the parts needing to be cut, then cut off the useless part, You can adopt method such as gas cutting、shear ,bring two things into contact properly.

(6) Weld the welded seam with oxygen acetylene weld or CO2 blocking welding. Weld properly

to take the small weld nugget as positioned weld according to interspaces of 30mm-50mm, carry out welding in order after knocking ,make the surface to be flattened. In the case of welded seam which needs high intensity, it is better for you to adopt two sided welding mothod.
(7) Flatten the welded seam with flat hammer, eliminate the welding pressure, then shaping it, and polish the welded seam with rotary sander.

2.2.4 Recovery of fold

Fold includes “live folding”and“dead folding”according to damage degree of sheet metal pieces, “live folding” means the slight fold which is can be eliminated directly by knocking the protruding with hammer. “dead folding”refers to the serious folded part which squeeze together tightly, two edges of the fold will become more and more “dead”, even cannot be relaxed if you directly knock the protruding with hammer, therefore it is called “dead folding”.In principle, recovery of fold is to open the “dead fold” first, make it unfolded gradually ,and make it become “living fold”, then change the“live folding”to rough and uneven in surface, recover the rough and uneven ones accordingly. The repair procedures are introduced as follows:
(1)Put the straightening force opposite to percussive force on the folded place adopting unfolding method, make the fold unfolded, make the fold relaxed.
(2) Dismantle the damage parts and put it on the surface plate, begin from inside of the fold, you can use suitable tools for prizing it open, heating with welding blow lamp while prizing it open, turn the “dead fold” to “living fold”.
(3) Flatten the “living fold” from inside fold area with hammer. The knocking point shall be put on the most protruding place. At the same time, it is necessary for you to make the surface plate to play the role of mat while knocking. After it is ok, you can rotate the parts to knock the other side until the folded parts are unfolded totally.
(4) Make it recover basically by means of heating and knocking while measuring with the sample.
(5) After installing the finished parts in the vehicle body, you can check it according to the sample; you can make further and finer straightening work in order to make it achieve the goal eventually.
(6)You can adopt digging recovery method if it is impossible for you to repair the serious folded damage in local position of sheet metal parts.

2.3 Welding of four doors and two lids

The following welding methods can be applicable to door welding: oxygen acetylene weld 、 CO2 blocking welding、hand work arc welding、resistance spot welding、brazing .Furthermore, in order to not make the vehicle lower its own strength and durability, you’d better adopt the same welding method as original maker’s as possible as you can, size and type of all welding sockets shall be similar to the original maker’s.
In the case of appearance quality, defects such as burn-through, half point,fissure and large amounts of fins for weld nugget shall be prohibited, surface of weld nugget shall be smooth and good-looking, obvious twisted deformation shall not be allowed, depth of press mark shall be

less than 20% of the plate thickness; As to whether or not strength of weld nugget is strong

enough, you can make use of shovel and hammer to carry out negate damaging test. You can knock in between two weld nuggets with shovel,to see whether or not it will be sealing off, you can knock it with hammer for the recovery. Flash shall be prohibited in the case of welded seam, lapping welded seam shall be good looking, defects such as air hole and fissures on surface shall be prohibited, and defects such as undercutting, overlapping and burn-through shall be prohibited while welding.

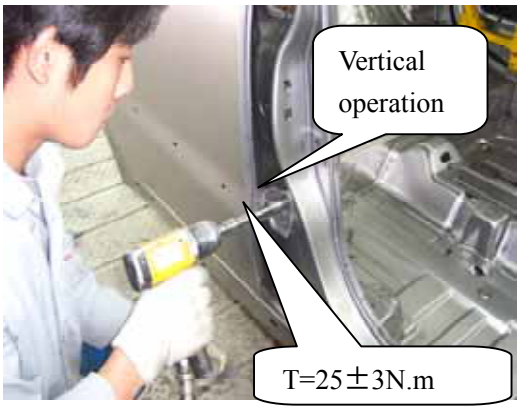
2.4 Installation of four doors and two lids

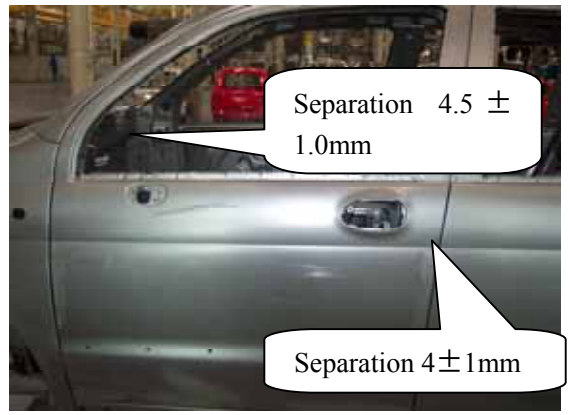
Installation of door and lid mainly involve levelness, clearance and hinge moment of force, the concrete procedures are introduced as follows:

2.4.1 Put your right hand in the installation hole, hold the upper edge of door frame tightly with left hand; make lower edge of door panel and upper edge of wind hole touch tightly, then make the door panel and wind hole edge keep close together perfectly.

2.4.2 Put 4mm iron of plug and magnet on the illustrated position properly, iron of plug has clearance under control, magnet has levelness under control.

2.4.3 Tighten the M8×22 combination bolts in proper order by hand, then hold the front end of wrench by left hand shown as the illustration, hold the handle by right hand, operate vertically, make the door hinge and hull structure body tightened.



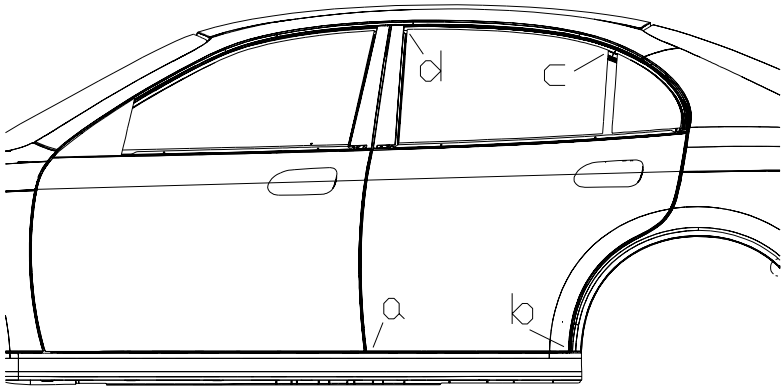


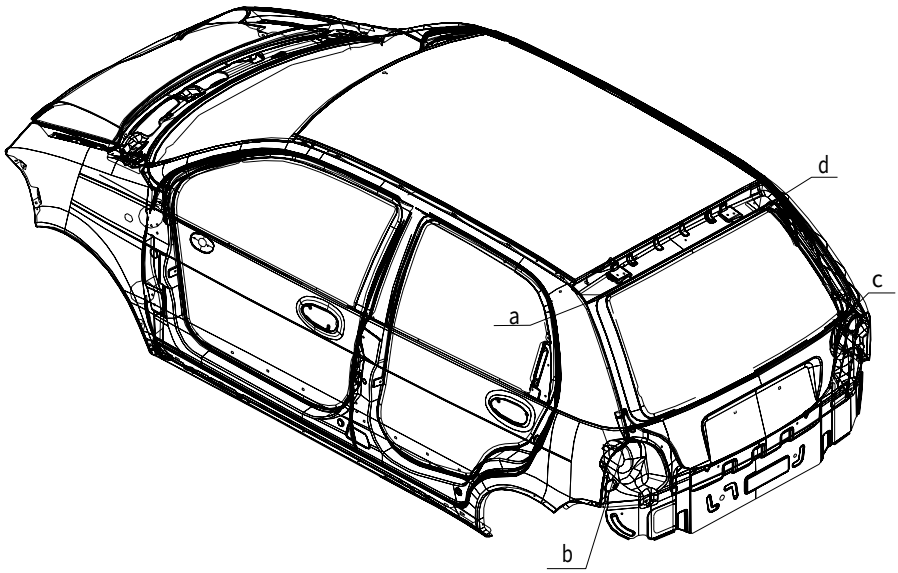
2.4.4 Adjustment: After adjusting the rear door assembly, it is necessary for you to tune-up the levelness, clearance and alignment between rear door assembly and the lateral enclosure, levelness of a～b is -1.3（0～0.5）mm, requested clearance is 4.0±0.5mm；levelness of b～c is 0,requested clearance is 4.0±0.5mm；Levelness of c～d is 0,requested clearance is 4±0.5mm；levelness of d～f is －0.7，requested clearance is 4.5±1.0mm；Alignment needs the door crest line is slightly higher 0.1～0.3mm than the crest line of lateral enclosure.

While adjusting front door assembly, it is necessary for you to tune-up the levelness and clearance between the front door assembly and upper part of lateral enclosure, the levelness is -1.3(0～0.5)mm，requested clearance is 4.5±1.0mm ;Levelness and clearance between front door assembly and lower part of lateral enclosure, levelness is -0.7(-1.0～0)mm，requested clearance is 4.5±1mm；levelness, clearance and alignment between front door assembly and rear door assembly, levelness is -0.3(0～0.5)mm，requested clearance is 4±1mm,alignment of front door crest line is slightly higher 0.1～0.3mm than the crest line of rear door. Top of front door and rear door, alignment of front door and rear door bottom part is 0±1.0mm。

While adjusting the rear back door assembly, it is necessary to tune-up the levelness, clearance and alignment of rear back door assembly and the lateral enclosure, levelness above point a is ±0.5mm，requested clearance is 4.4±1mm；levelness below point b is 0.8（-0.5～0）mm, requested clearance is 5.4±1mm；levelness above point a～b is 3.5（-1～0）mm，requested clearance is 4.4±1mm；tune-up the levelness and clearance of rear back door and the roof, the levelness is 0.4（-0.5～0）mm, requested clearance is 0.4（-0.5～0）mm. Alignment between rear back door and rear wing is 0.

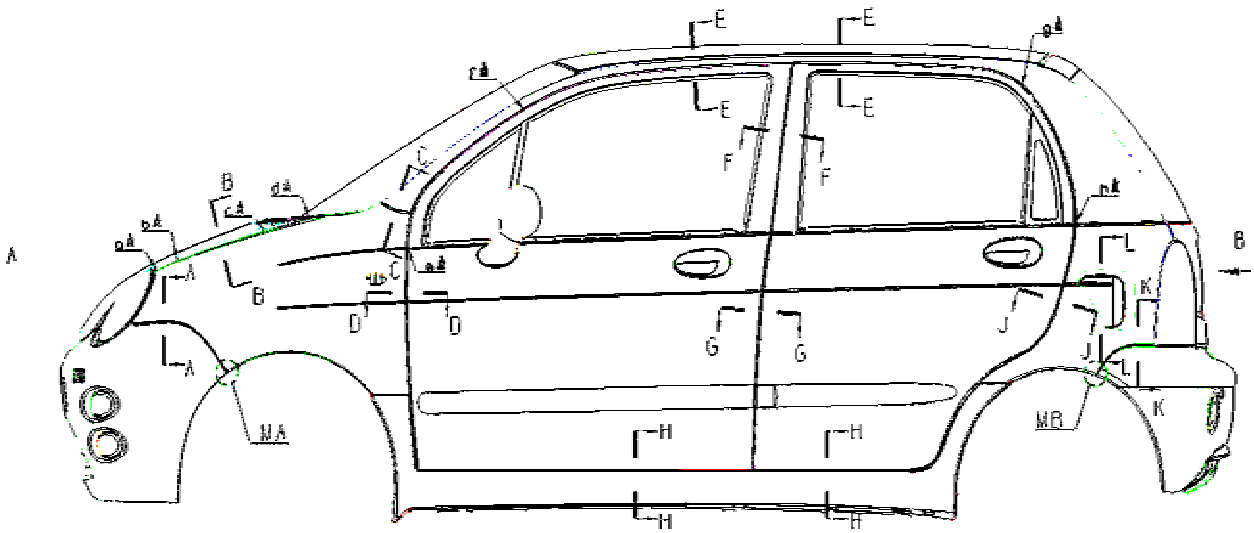
While adjusting the engine head assembly, tune-up properly the clearance, levelness and alignment between the engine head and the wing, clearance is 4±1mm，,requested levelness is 1±0.5mm；fix the engine head assembly on the hinge with M6×12 Allen bolts by hand, tighten it with pneumatic screwdriver (model: LUM 25 hr05),technological torque is T=10±1Nm；The engine head assembly and the wing are transitive smoothly; alignment of front end is 0±1mm.





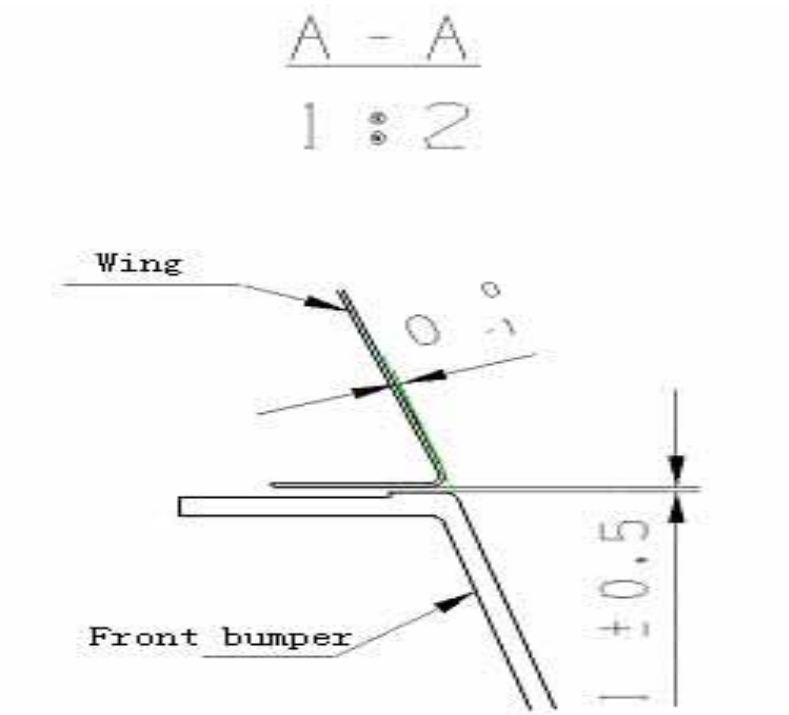
2.5.2 Dimension of vehicle body

2.5.2.1 Side view

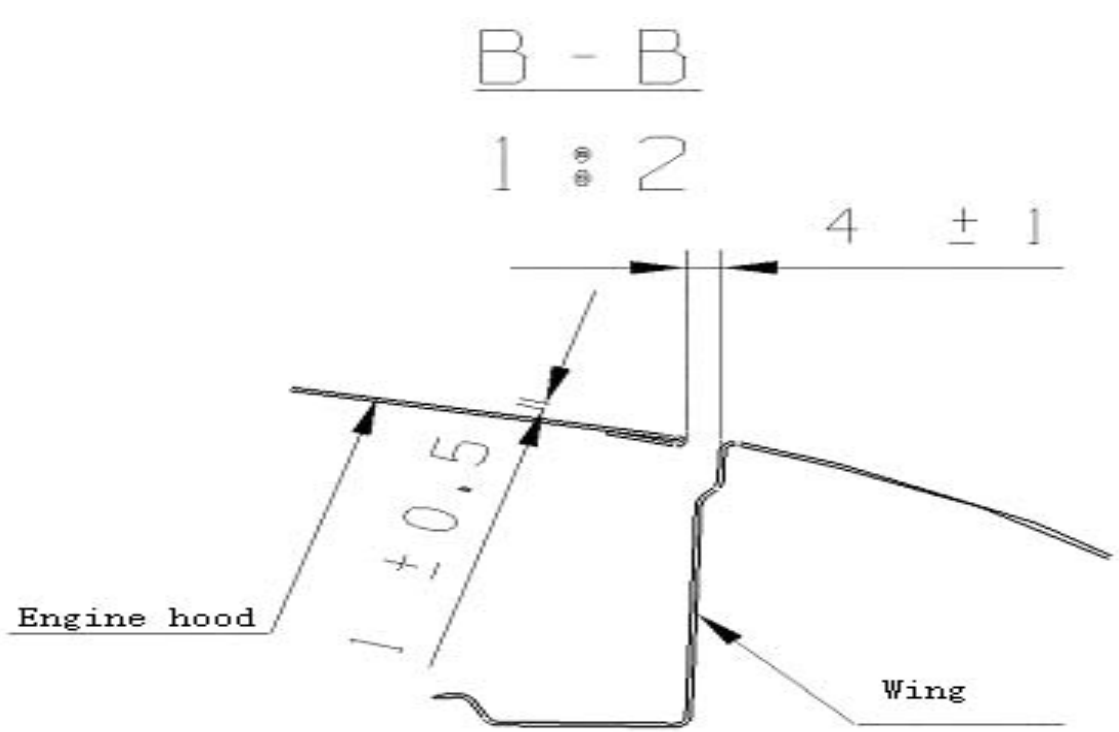


In the illustration: point a to point b, point d to point c, alignment is transitive evenly from 0 to 1,point e to point f, point h to point g, the clearance is transitive evenly from 4 to 4.5.other The cross section is introduced as follows:

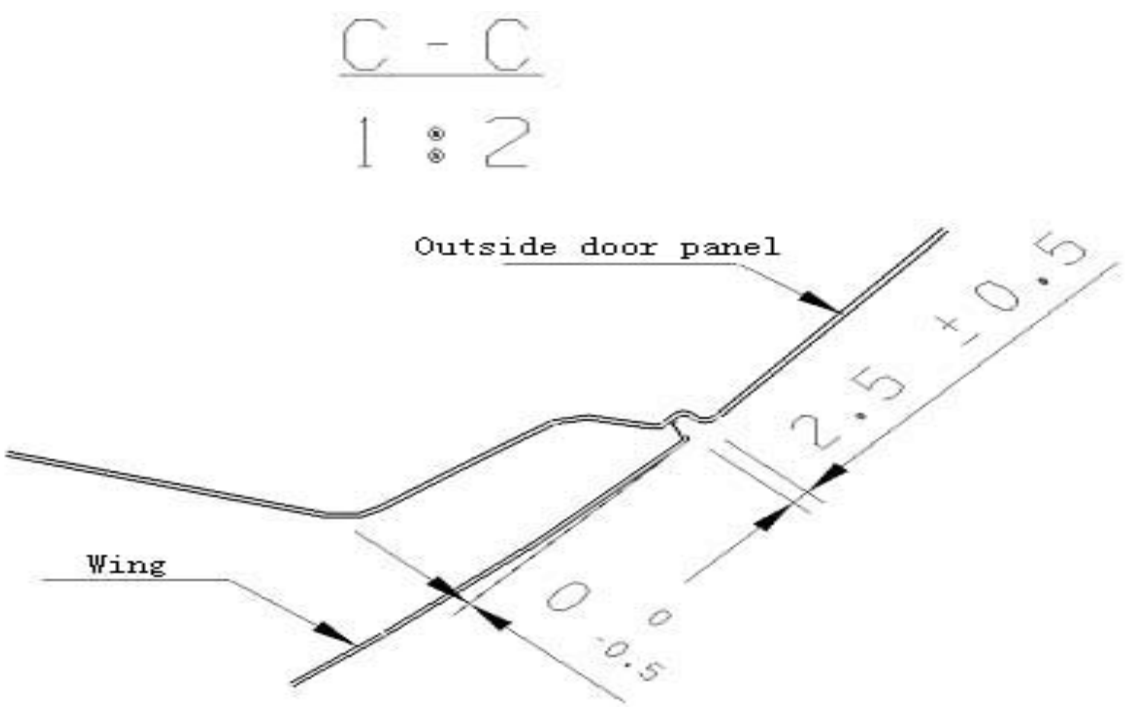
A-A The cross section, the request of clearance and plane



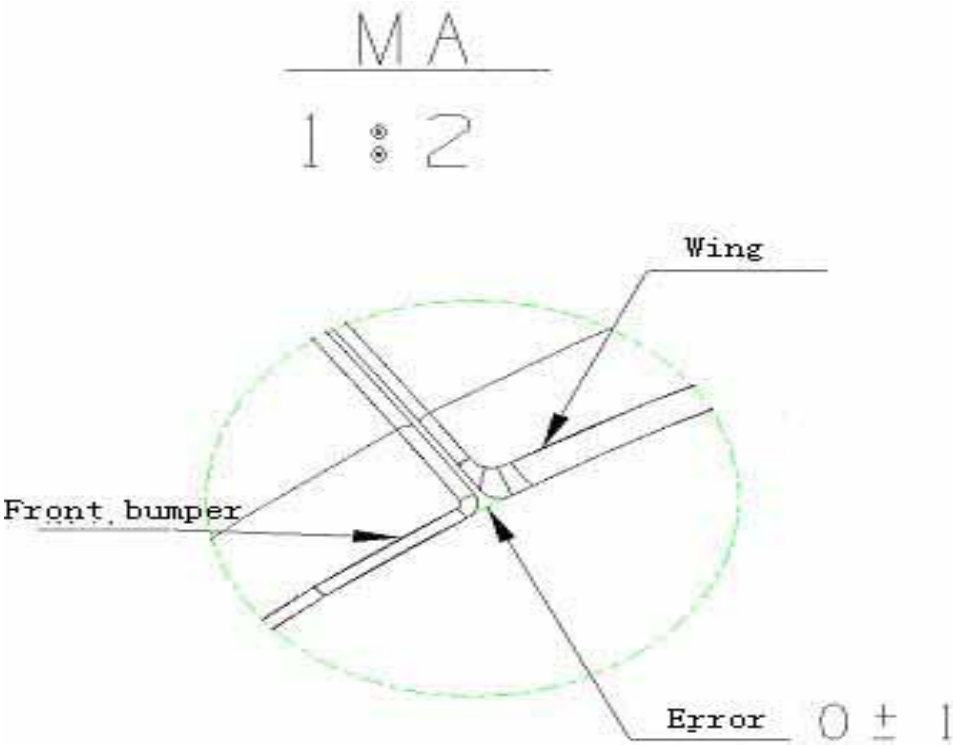
B-B The cross section, request of clearance and plane



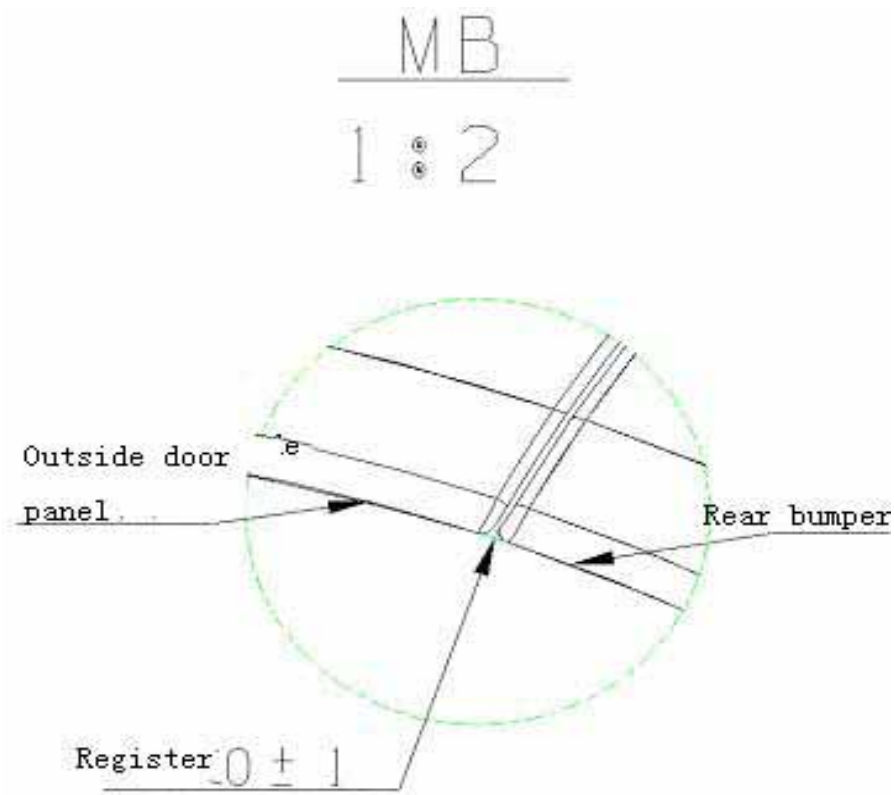
C-C The cross section, request of clearance and plane



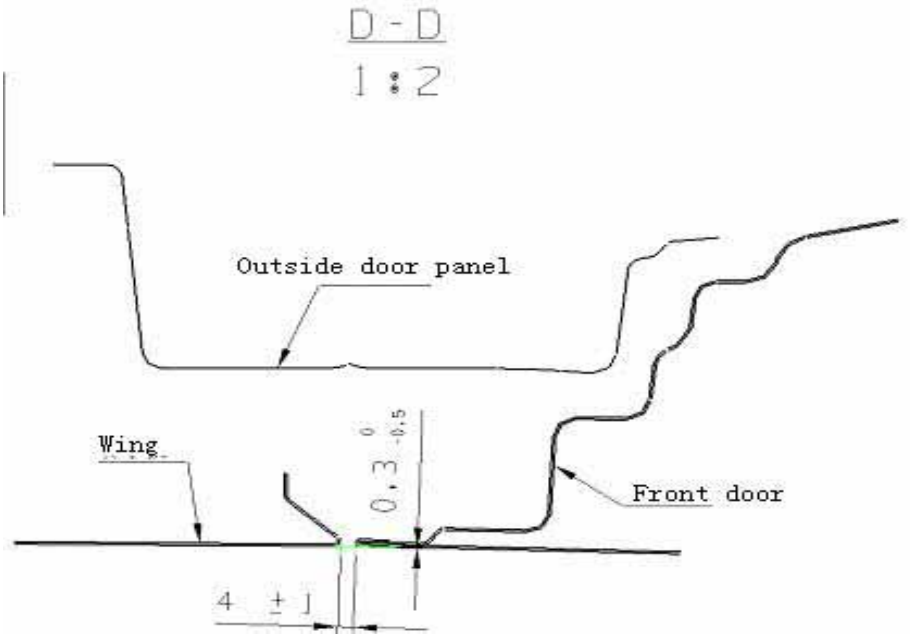
MA The cross section enlarging figure, request of plane is 0±1



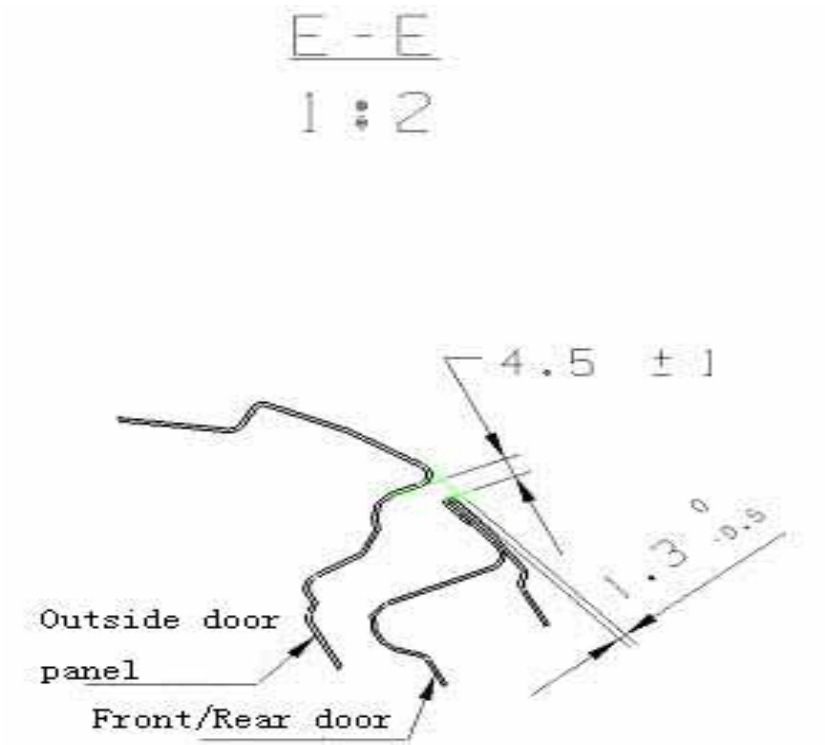
MB The cross section enlarging figure, request of plane is 0±1



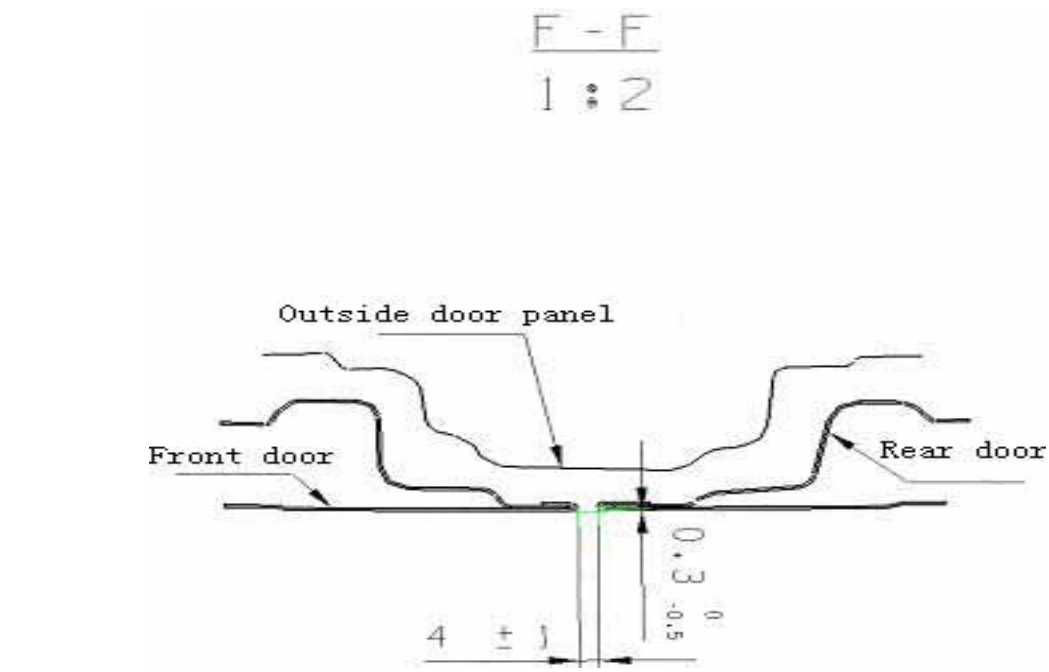
D-D The cross section, request of clearance and plane



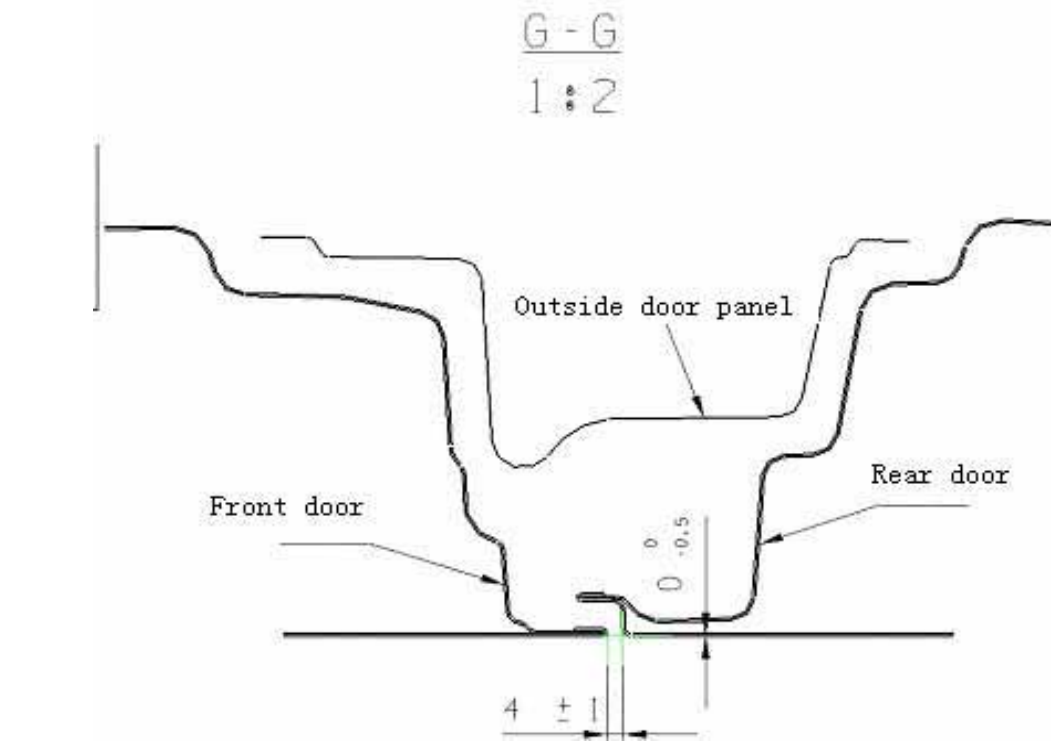
E-E The cross section, request of clearance and plane



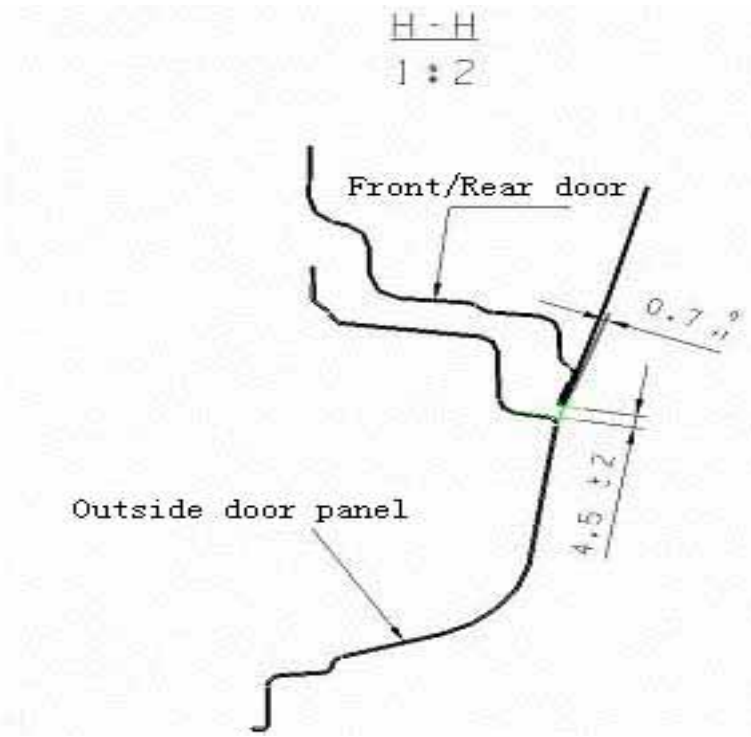
F-F The cross section, request of clearance and plane



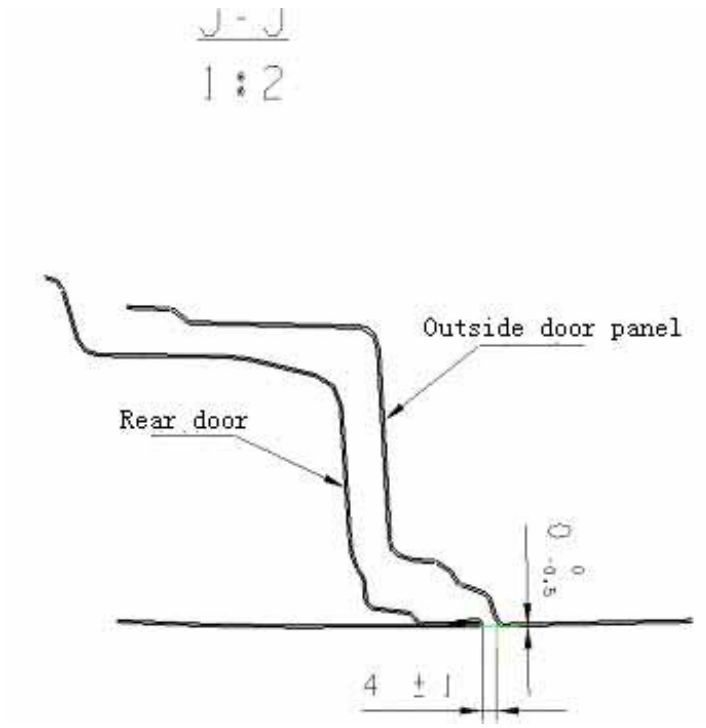
G-G The cross section, request or clearance and alignment



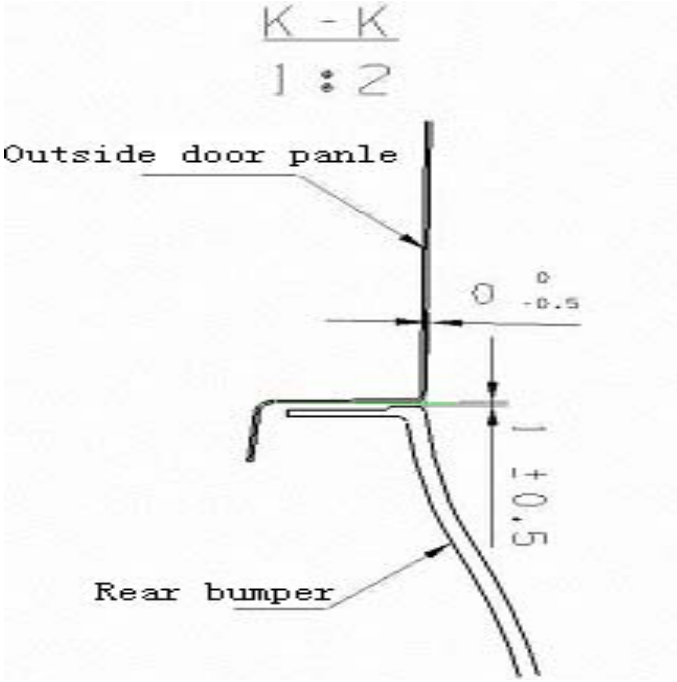
H-H The cross section, request of clearance and plane



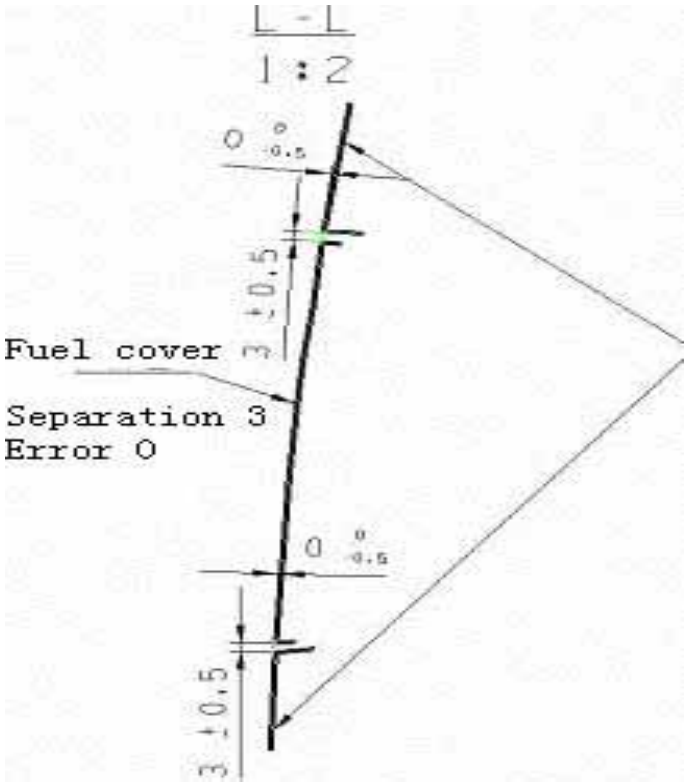
J-J The cross section, request of clearance and plane



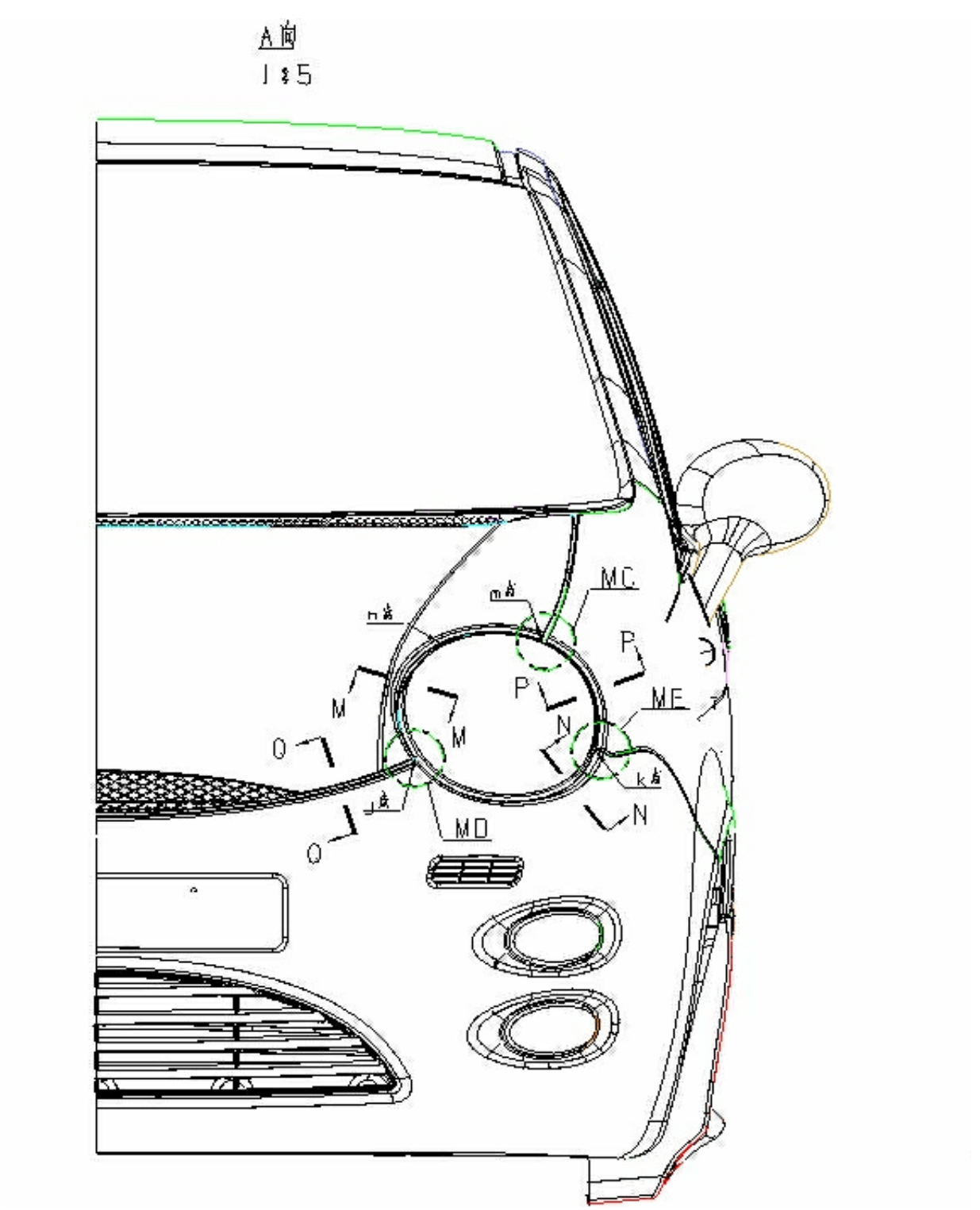
K-K The cross section, request of clearance and plane



L-L The cross section, request of clearance and plane

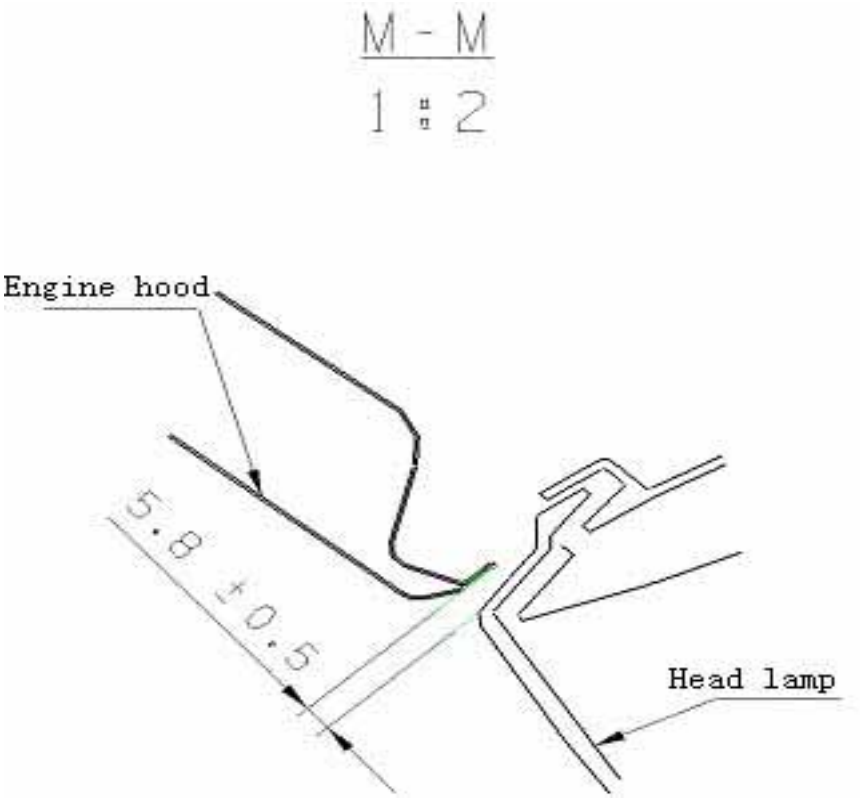


2.5.2.2 Front view figure

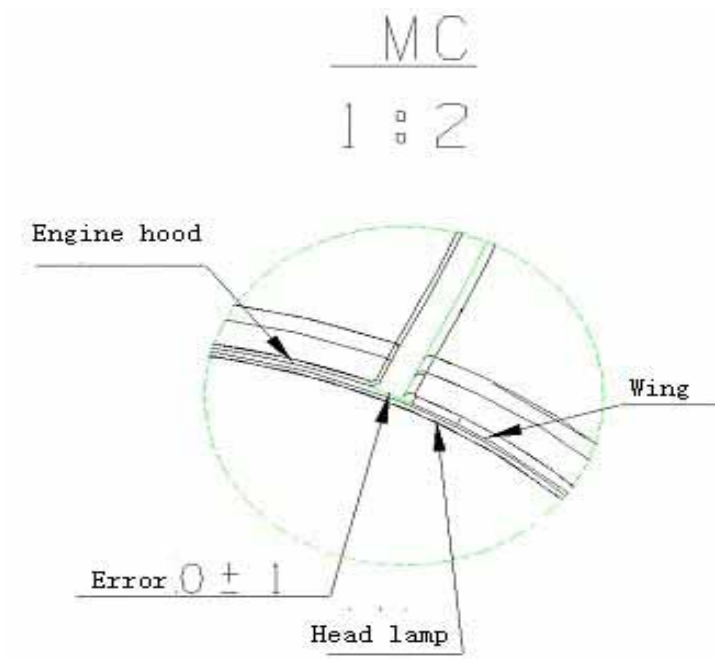


In the figure: From point m to point n, clearance is transitive evenly from 3.6 to 5.8,from point j to point k, the clearance is transitive evenly from 5.8 to 3.6.

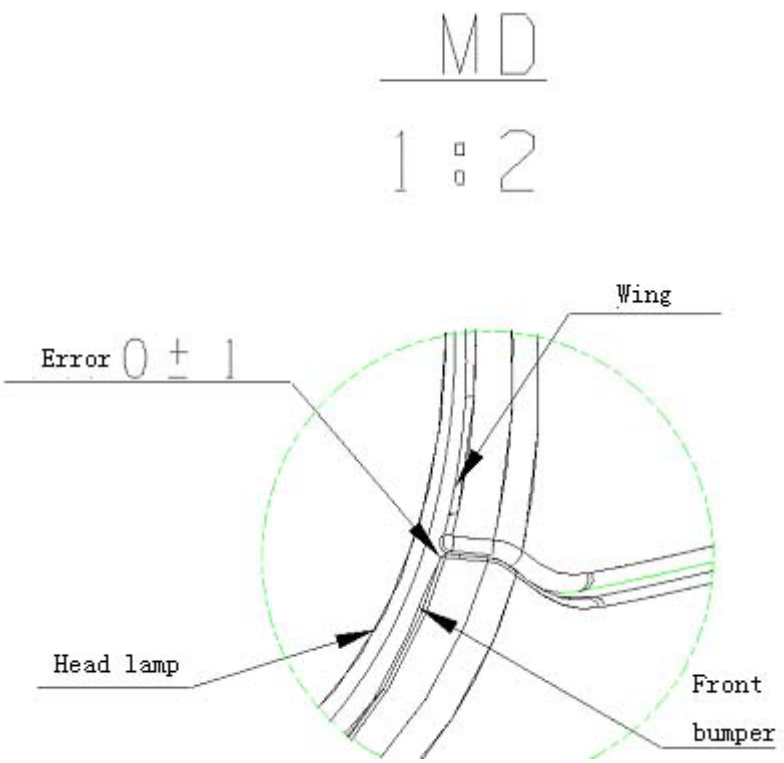
M-M The cross section, request of clearance and plane



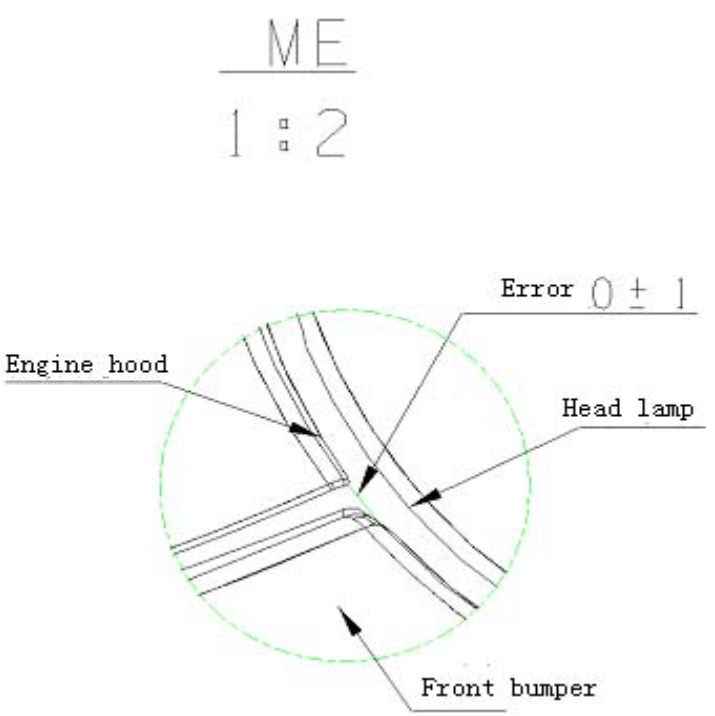
MC The cross section enlarging figure, request of plane 0±1



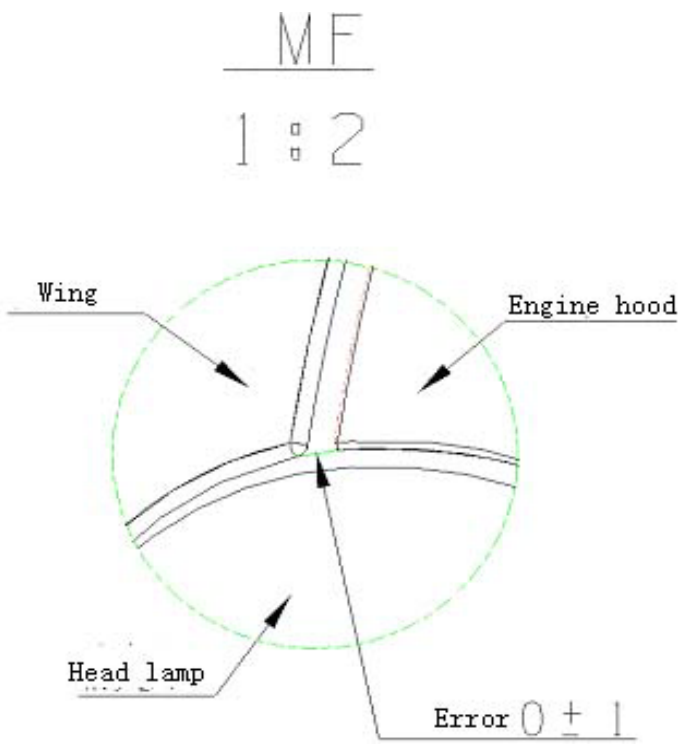
MD The cross section enlarging figure, request of plane is 0±1



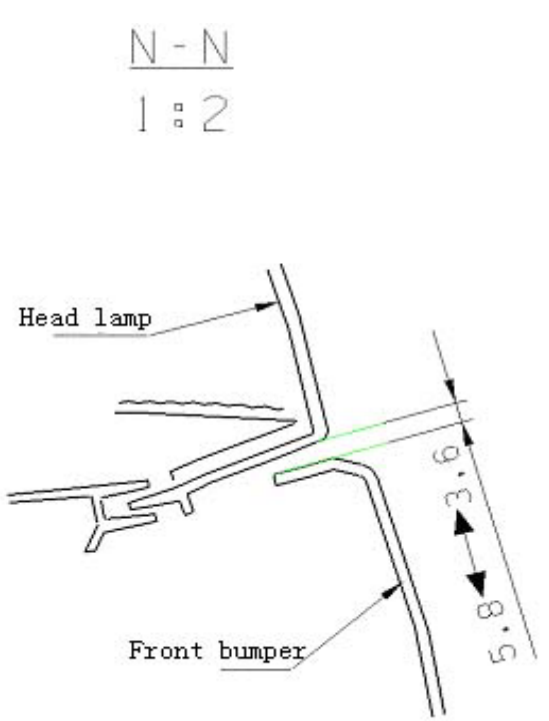
ME The cross section enlarging figure, request of plane is 0±1



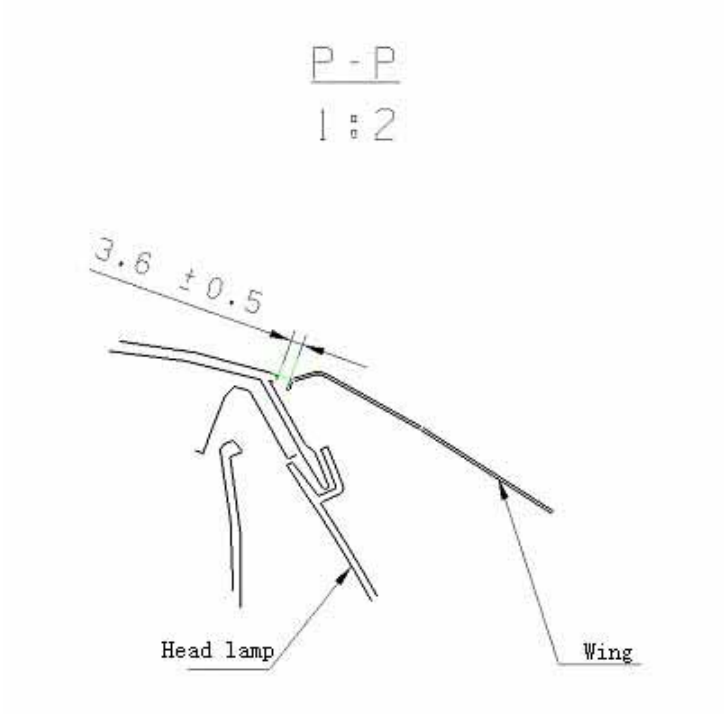
MF The cross section enlarging figure, request of plane is 0±1



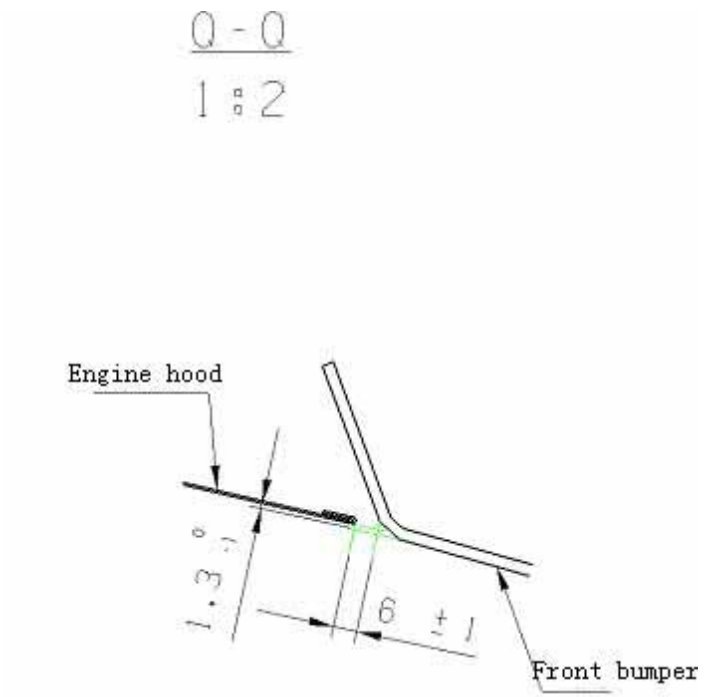
N-N The cross section, request of clearance and plane



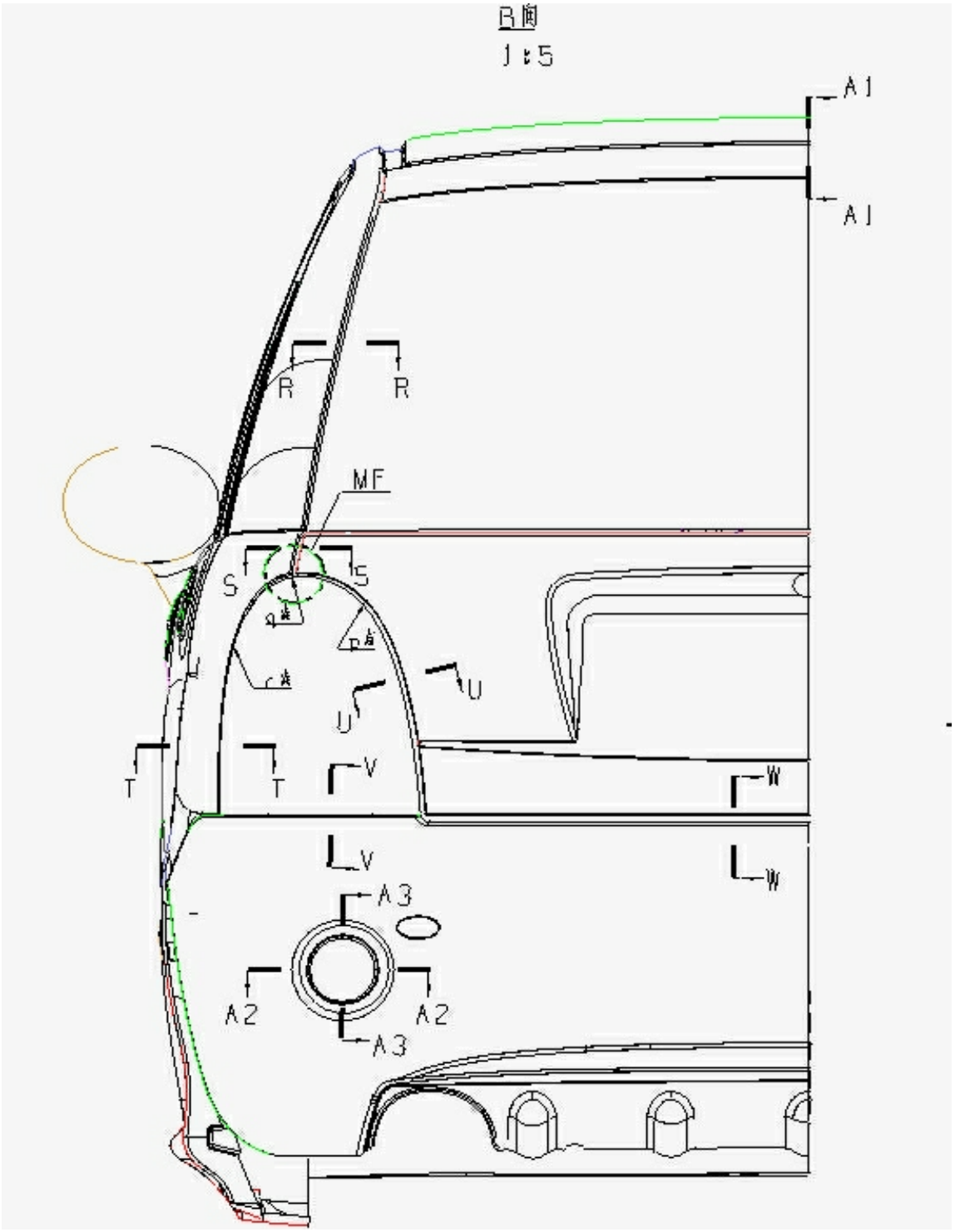
P-P The cross section, request of clearance and plane



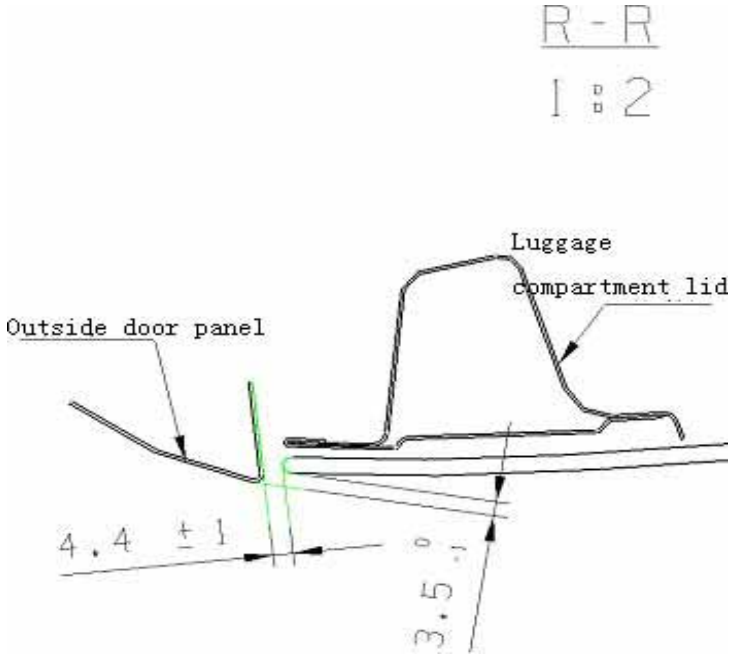
Q-Q The cross section, request of clearance and plane



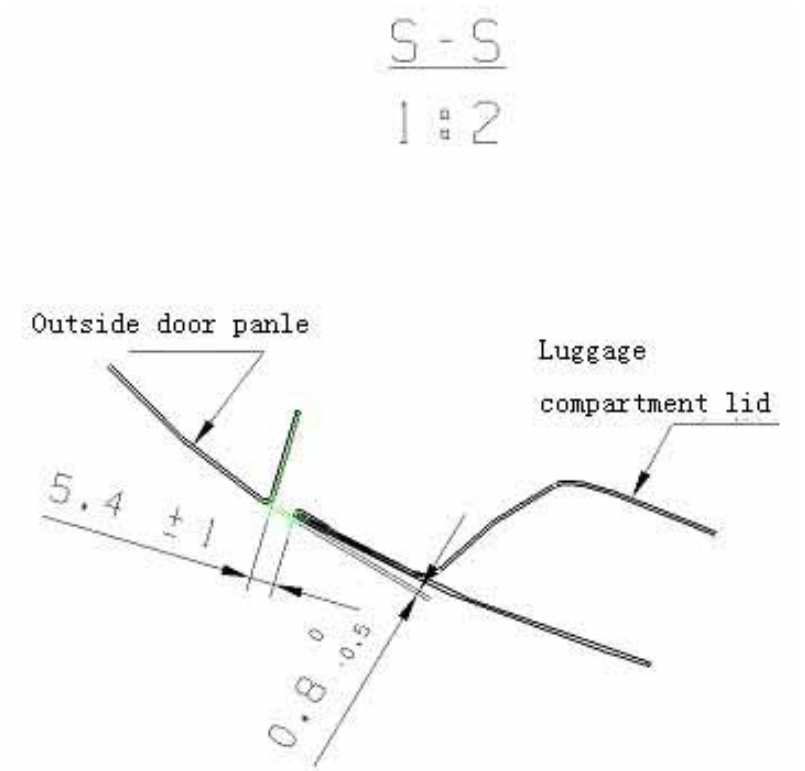
2.5.2.3 Rear view figure



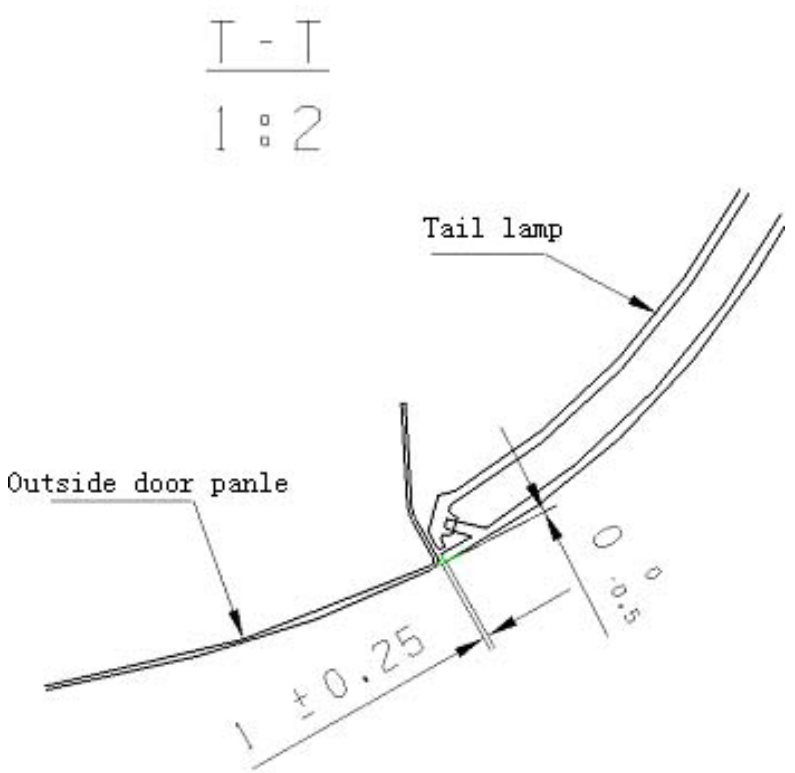
R-R The cross section, request of clearance and plane



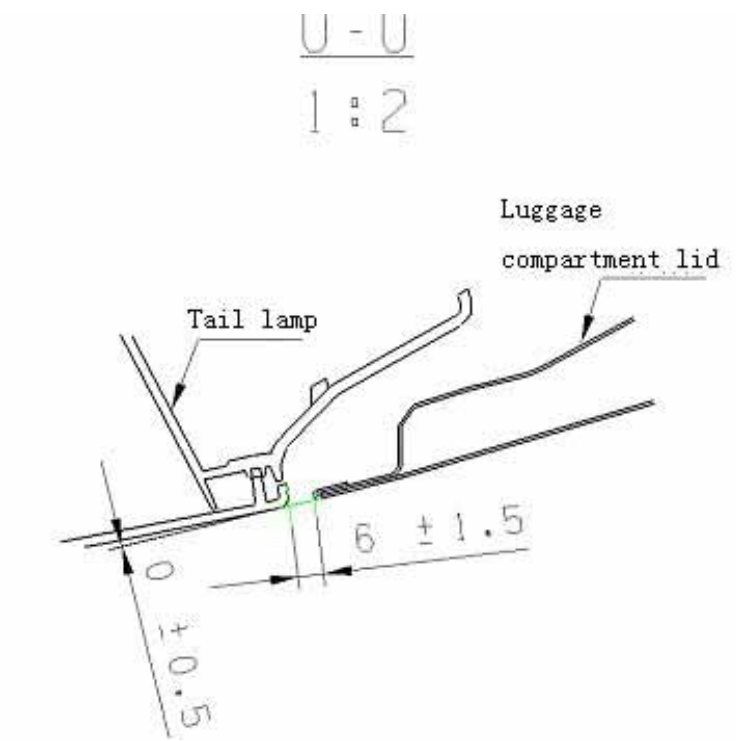
S-S The cross section, request of clearance and plane



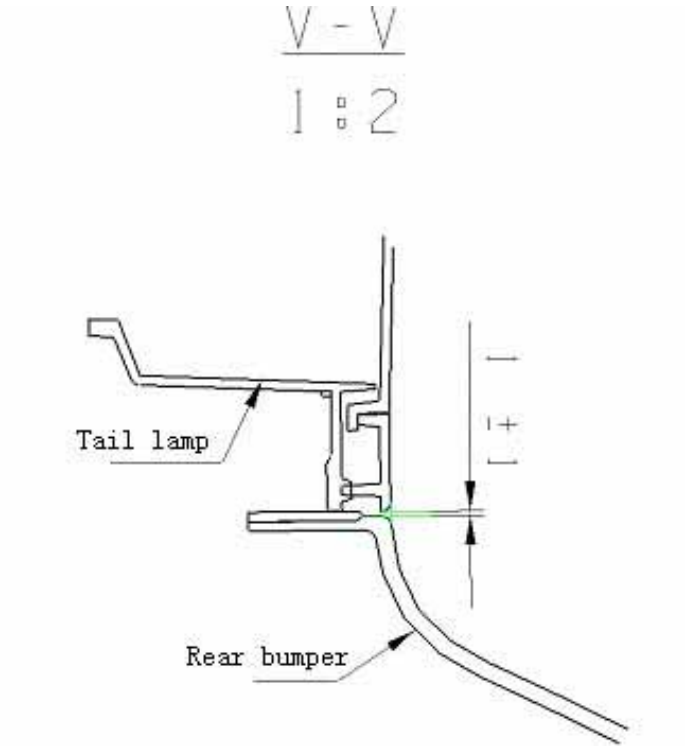
T-T The cross section, request of clearance and plane



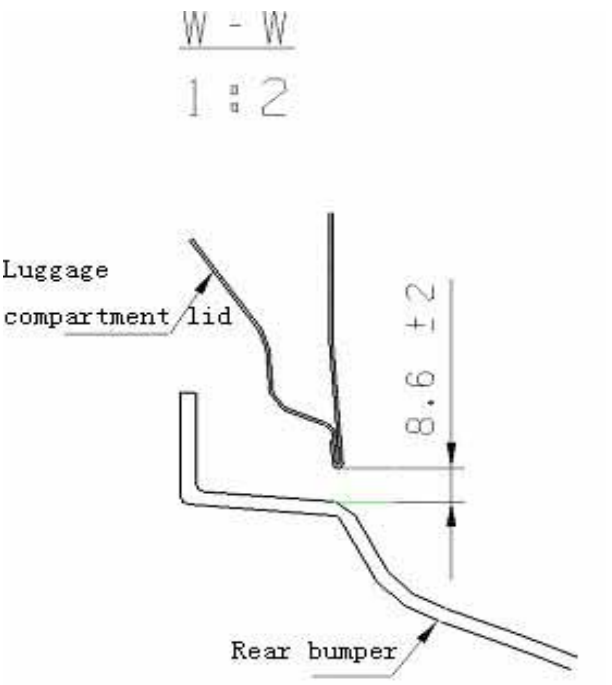
U-U The cross section, request of clearance and plane



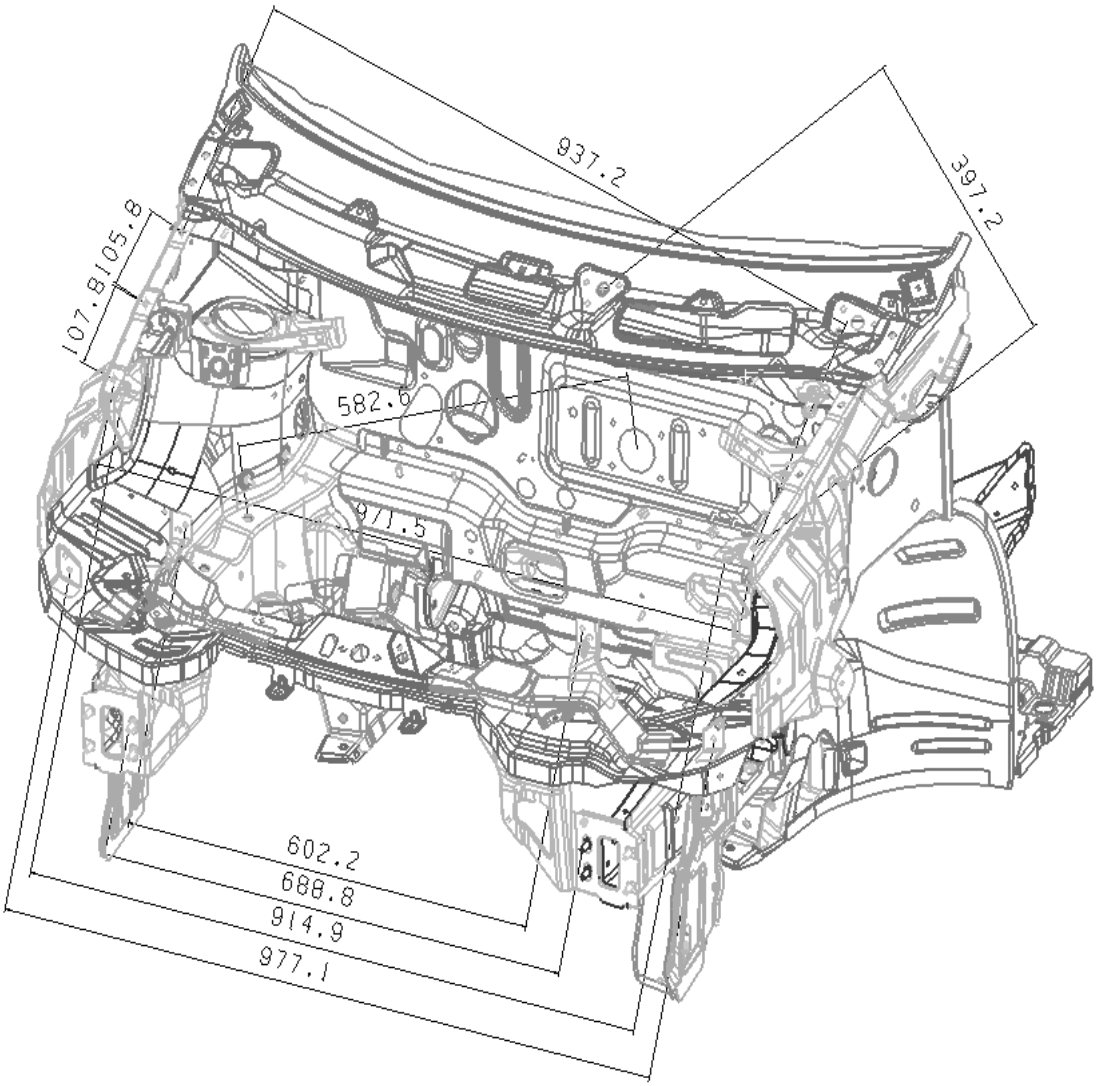
V-V The cross section, request of clearance and plane



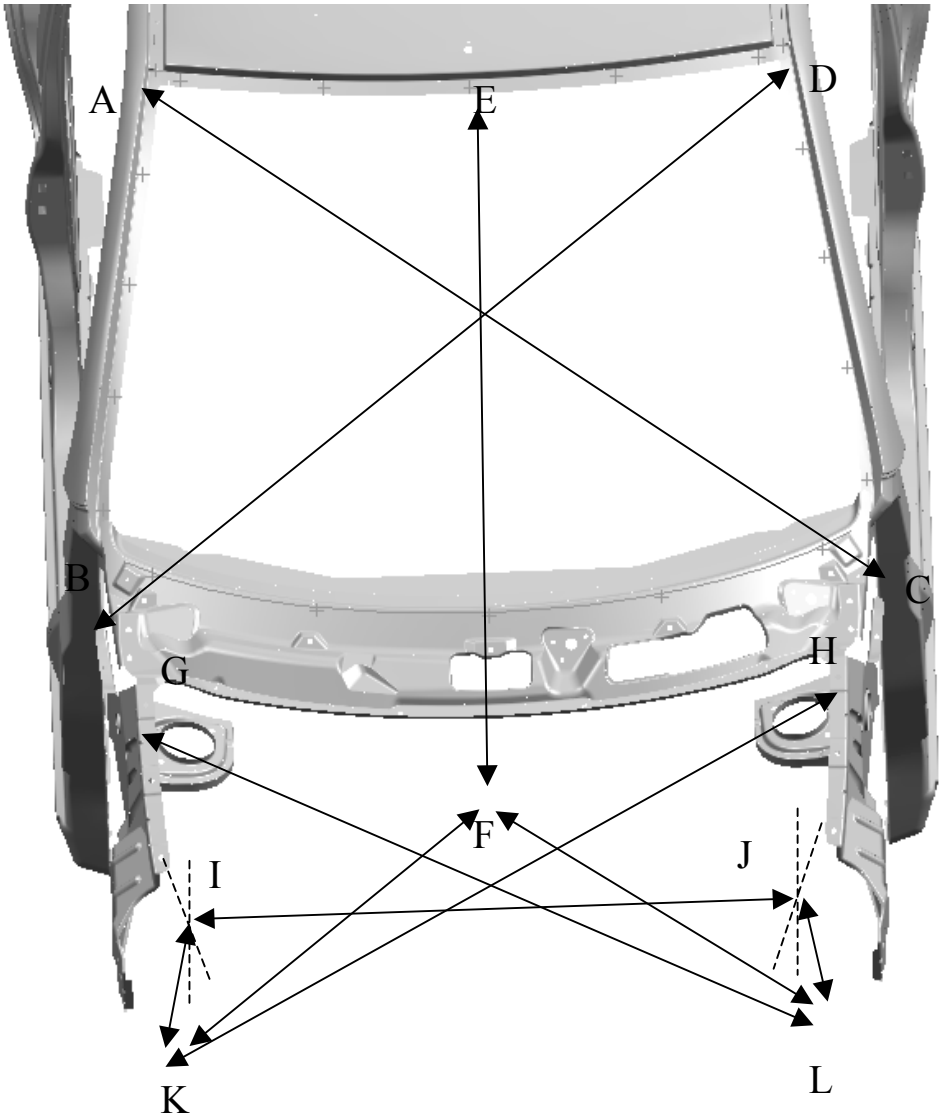
W-W The cross section, request of clearance and plane



2.5.2.4 Dimension of engine room

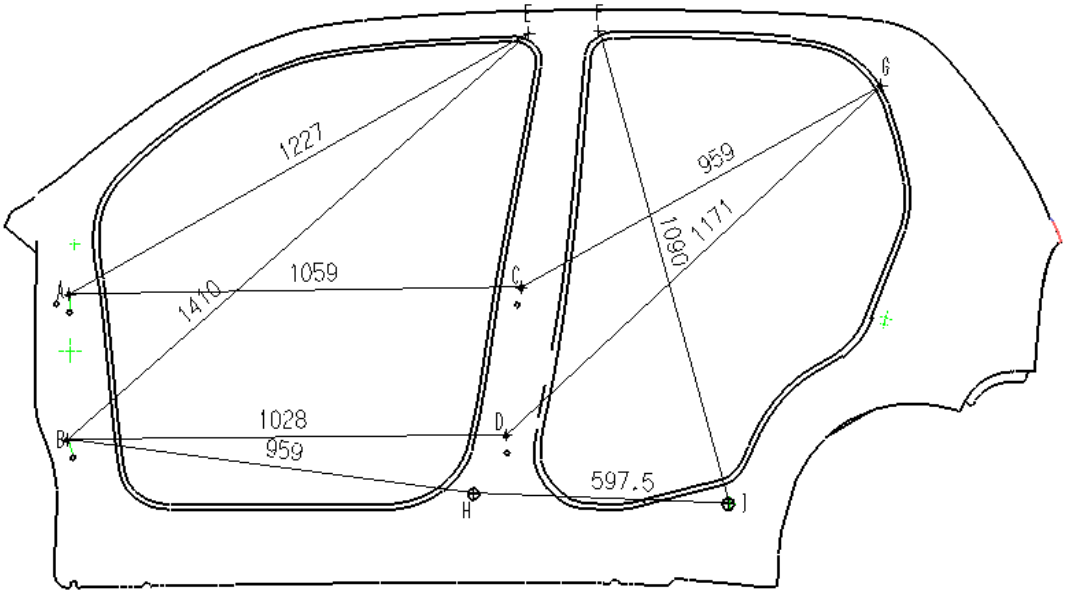


2.5.2.5 Distance dimension between two points of every part



No.	Control dimension	Remark
AC	1326.7±1.5	Front windshield diagonal
EF	908.8±1	Front windshield YO position distance
KI	345.7±1	Center distance between front shock absorber and front wheel housing outside panel front end port
KF	622.2±1	Center distance of front cover upper member body center pit and front wheel housing outside panel front end port
KH	1206.0±1.5	Diagonal distance from front cover upper member body port and front wheel housing outside panel front end port
IJ	971.6±1.5	Center distance of Left/Right front shock absorber port

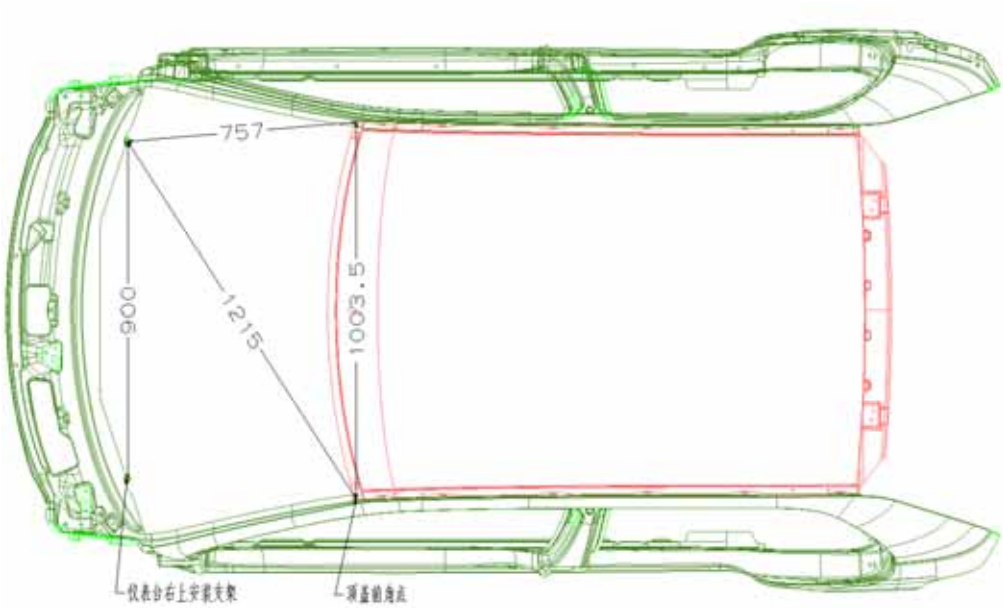
Note： AC=BD KI=LJ KF=LF DH=LG



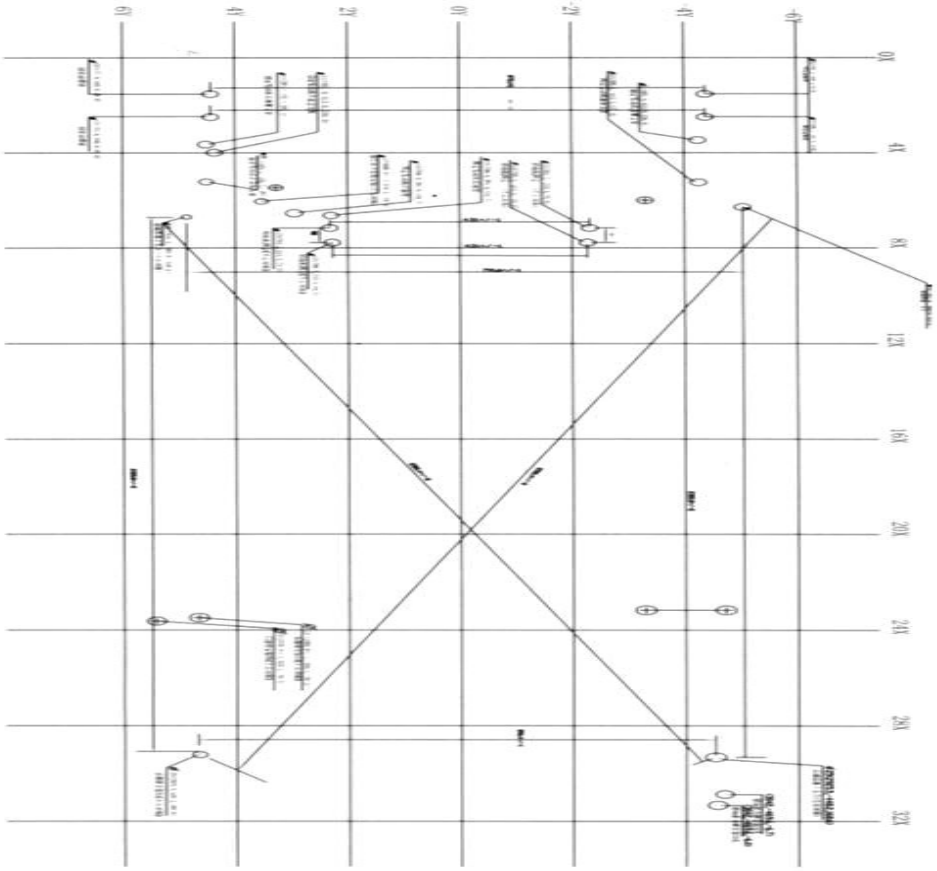
Dimension of vehicle body , Left/Right Remark: Capital letter English alphabet symbol shows right side of vehicle body , small letter shows left side of vehicle body (See from rear part of vehicle)

A-a	B-b	C-c	D-d	E-e	F-f	G-g	H-h	I-i
1323	1365	1356	1356	1049	1045	1137	1368	1363

Symbol	Name	Aperture	Symbol	Name	Aperture
Aa	Front door upper hinge mounting hole	11	Ff	Sidewall rear door hinge front upper angular point	
Bb	Front door lower hinge mounting hole	11	Gf	Sidewall rear door hinge rear upper angular point	
Cc	Rear door upper hinge mounting hole	11	Hh	Front door supporting point	23
Dd	Rear door lower hinge mounting hole	11	Ii	Rear door supporting point	28
Ee	Sidewall front door slide upper angular point				



2.5.2.6 Crossbeam size



2.5.2.7 Reference point --- symmetry

Symmetrical reference points

Symmetrical reference points refer to the two corresponding points which are located symmetrically on the centerline with same length, width and height; you can make use of the symmetrical reference points to carry out high-speed check-up, so as to make sure that the damage degree of bottom configuration parts of the vehicle body.

2.5.2.8 Reference points ___nonsymmetrical

Non-symmetrical reference points

The two points are non-symmetrical reference points when the two points possess different dimensions. If you carry out high-speed check and the result measuring values are different, you must check the measuring value according to the standard dimensions of vehicle body to see whether or not the measuring points are symmetrical.

2.5.3 Diagnostic information and procedures

2.5.3.1 Inspection of alignment

You should make sure the alignment of bottom vehicle body with measuring gauge, while carrying out the recommended measurement and check, measuring gauge assembly must include the vertical indicator which stretch out 914mm.The following measurement can be carried out with the measuring gauge:

● Point-to- point direct measurement

● Carry out computation measurement on the datum line of the level surface which is parallel to the bottom vehicle body.

Set up one of the following indicator accordingly for every measuring point:

- Height indicator
- Verticality indicator

Measure point-to-point distance on the following parts:

● Steering parts of front structure

● Suspension parts

Make sure that the vertical indicator is set up similarly

Under some certain circumstances, you can use one of the following tools to measure the point-to-point distance directly:

● Tape measure

● Suitable measuring tools

Measure the dimension from the hole to the following positions:

● Forward position or core of the hole

● Aligning with the neighboring surface metal see “measurement – bottom vehicle body” for reference, understand the following installation:

● measuring points arranged in alphabetical order

● Conversional data of dimension changing from the metric system to avoirdupois system

2.5.3.2 Inspection of alignment – bottom vehicle body

Three dimensional methods

It is necessary for the repair equipment to measure the length, height and width of many measuring points simultaneously, it is also necessary for it to measure 2/3 of the vehicle body to make things convenient for comparing the structure of vehicle body accurately.

General-purpose measuring system combines the use equipment with the technique to carry out dimensional measurement including measurement of length, width and height.

2.5.4 Explanation and operation

2.5.4.1 Explanation of datum

Datum

Datum line is parallel to the bottom vehicle body or frame, and the above-mentioned surface is the datum for all vertical measurement. Datum line is an imaginary level surface, it locates on the bottom vehicle body, at the same time, and it is parallel to the bottom vehicle body. The height results from distance measured from the datum line to the certain specified measuring point or reference point of bottom vehicle body by means of vertical measurement. Dimension of height is based on use equipment; it decides the position of datum line. Therefore, you can set different datum lines for the same vehicle, you can plus and subtract the same numerical value from all height to establish a new datum you need.

Centerline

Centerline is an imaginary vertical surface; it is vertical with the length direction of datum surface, and pass through the vehicle centre. Centerline refers to the arbitrary straight lines passing through the datum surface center of the vehicle.

Forming and perforation

Forming and perforation is a process of manufacture, which can form a region on the metal structure easy for you to carry out three dimensional measurements. You can perforate a hole or groove on that region easy for dimensional measurement and join together with other parts structurally. All measuring results can be read-out from the centerline of a formed surface and hole.

All dimensions can be measured from the following aspects:

- Length to the zero line (1)
- Height to the datum line (2)
- Width to the centre line (3)

All dimensions are symmetrical if there are no other regulations.